Source Data Applicability Impacts on Epistemic Uncertainty for Launch Vehicle Fault Tree Models

Abstract

Launch vehicle systems are designed and developed using both heritage and new hardware. Design modifications to the heritage hardware to fit new functional system requirements can impact the applicability of heritage reliability data. Risk estimates for newly designed systems must be developed from generic data sources such as commercially available reliability databases using reliability prediction methodologies, such as those addressed in MIL-HDBK-217F. Failure estimates must be converted from the generic environment to the specific operating environment of the system where it is used. In addition, some qualification of applicability for the data source to the current system should be made. Characterizing data applicability under these circumstances is crucial to developing model estimations that support confident decisions on design changes and trade studies.

This paper will demonstrate a data-source applicability classification method for assigning uncertainty to a target vehicle based on the source and operating environment of the originating data. The source applicability is determined using heuristic guidelines while translation of operating environments is accomplished by applying statistical methods to MIL-HDK-217F tables. The paper will provide a case study example by translating Ground Benign (GB) and Ground Mobile (GM) to the Airborne Uninhabited Fighter (AUF) environment for three electronic components often found in space launch vehicle control systems. The classification method will be followed by uncertainty-importance routines to assess the need to for more applicable data to reduce uncertainty.

Topic: Probabilistic Risk Assessment

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